



Research Article

IMPACT ASSESSMENT OF HAILSTORM DURING APRIL 2020 ON VARIOUS CROPS IN JASHPUR DISTRICT OF CHHATTISGARH STATE

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Abstract: Hailstorm is occasionally occurring in Jashpur district during winter and summer season due to some western disturbances causing crops damage and losses including houses. The occurrence has reduced the commercial as well as appealing value of the crops. So far meager information is available on impact of hail damage on horticultural and agricultural crops. Therefore, the main objective of this study was conducted to monitor the impact of hail storm on Rabi crops, summer paddy and other horticultural crops. Result showed significant cropped area damaged in all the crops at varying degree. Weight of hails was found to be around 100 grams and its typical diameter was found near H0 to H3 categories which severely damaged households and agricultural and horticultural crops. However, the severity of damage was higher at flowering, fruit setting stage and nursery stage. In affected villages 750.3 ha area affected by hailstorm which is 38% of net sown area of affected villages of Pathalgaon block and 14.6 ha area affected at villages of Farsabhar block which is 80% of net sown area of affected villages.

Keywords: Hailstorm, Agriculture, Western Disturbance, Injury, Crop

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Introduction

Hail is a solid, frozen form of precipitation that causes extensive damage to properties and growing crops [1]. Hailstorm is not uncommon in India and its incidence has been reported yearly in some parts of the country. Hailstorms are severe convective weather systems commonly seen in the spring and summer. Hail is precipitation produced by hailstorms in the form of balls or irregular lumps of ice [2]. Pre monsoon season in north-east India is known for thunderstorm activity with moderate to heavy rain, gusty wind, squalls and sometimes with the occurrences of hail fall [3]. Impact of hail is usually localized, but the damage to crops-particularly at critical stages and infrastructure may be significant. Hail ranks as one of the most dangerous and destructive of all severe weather phenomena [4]. Even light hail tends to be followed by pest and disease attacks. It was reported that hailstorm ravaged standing crops of Marathwada and Vidarbha during February, 2018 has damaged crops to the tune of Rs 313 crore [5]. Maharashtra is more prone to hailstorms than other States in the country with maximum probability of occurrence (91-95%) while the probability of occurrence (6-10%) is least in Gujarat, Chhattisgarh, Tamil Nadu, Tripura, Meghalaya, Sikkim and Nagaland [6]. Hailstorm is occasionally occurring in Jashpur district with various intensities during winter and summer season due to some Western Disturbances. During study period hailstorm was reported at many villages of Pathalgaon and Farsabhar block of the district during the month of April which caused misery for several households due to crop loss and damage to houses in the pandemic circumstances of COVID-19. In areas of various villages of Pathalgaon and Farsabhar block, hailstorm was observed during 17 standard meteorological week (SMW) no. 17th in April 2020 which damaged various horticultural and agricultural crops as well as thousands of households. According to IPCC the incidence and intensity of such weather is expected to increase with climate change [7]. Hailstorm damage is one amongst the extreme weather events which severely affect the crops within a short span of time [8].

When evaluating hail damage, it is important to determine the stage of growth, the extent of damage to the stem, leaves, flowers and the fruit.

About Study Area

Jashpur District lies in the north-eastern corner of Chhattisgarh state in India adjoining the border of Jharkhand and Odisha and it has classified under northern hills agro-climatic zone of Chhattisgarh state. It is between 22°17' and 23°15' North latitude and 83°30' and 84°24' East longitude. It is divided geographically into two parts the northern hilly belt is called the Upperghat and the remaining southern parts known as Nichghat [9].

Materials and Methods

Hail characteristics and damage potential 1

The damages observed from hailstorms are determined by its diameters and number per unit area and intensity of and the wind gusts during a hailstorm. Specific type of hailstorm may not cause much damage during vegetative phase growing season but the same storm can be very destructive during flowering and seed/fruit development [10]. Hail characteristics and damage potential categorized by using following hailstorm intensity scale [10] furnished in [Table-1].

Data used 2

Village and crops wise net sown area and affected area collected from department of Agriculture, district Jashpur (CG) and it is converted in crop wise net area, affected area and percent affected area for total hail damaged area of Pathalgaon and Farsabhar blocks. Daily rainfall data of different blocks of Jashpur district has been collected from the department of revenue and disaster management district Jashpur Govt. of CG and weather database of department of Agrometeorology IGKV Raipur Chhattisgarh for the period of 61 years from 1960 to 2020

Table-1 Hailstorm intensity scale

Size code	Hail diameter (mm)	Equivalent shape	Intensity category	Typical damage impacts
H0	<8.4	Pea	Hard hail	No damage
H1	8.4 to 15.2	Marble	Potentially damaging	Slight damage to plants, crops
H2	15.2 to 20.3	Coin or grape	Potentially damaging	Significant damage to fruit, crops, vegetation
H3	20.3 to 30.5	Nickel to quarter	Severe	Severe damage to fruit and crops, damage to glass and plastic structures, paint and wood scored
H4	30.5 to 40.6	Golf ball	Severe	Widespread glass damage, vehicle Body work damage
H5	40.6 to 50.8	Tennis ball	Destructive	Wholesale destruction of glass, damage to Tiled roofs, significant risk of injuries
H6	50.8 to 61.0	Baseball	Destructive	Aircraft body work dented, brick wall pitted
H7	61.0 to 76.2	Grapefruit	Very destructive	Severe roof damage, risk of serious injuries
H8	76.2 to 88.9	Softball	Very destructive	Severe damage to aircraft body work
H9	88.9 to 101.6	Softball	Super hailstorms	Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open
H10	>101.6	Softball and up	Super hailstorms	Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open



Fig-1 Size and shapes of hail and damaging nature of households



Fig-2 Nature of damaging of various crops and plants affected by hailstorm

(that is different based on data availability) have been taken into consideration for analyzing block level long term weekly mean and percentage deviation for the SMW no 17th by using following equations.

Mean weekly rainfall 3

Mean weekly Rainfall (mm) = (Sum of weekly Rainfall) / (Number of Year)

Percentage deviation 4

Percentage deviation (%) = (Actual weekly RF - Normal Weekly RF) / (Normal Weekly RF)

Result and Discussion

Hailstorm at SMW no. 17th in the year of 2020 in Pathalgaon and Farsabhar block of Jashpur district severely damaged many Horticultural and Agricultural crops at many villages of Pathalgaon and Farsabhar block and thousands of households affected. Level of injury varies with crops and its stages collected from selected farmers filed after hailstorm and net sown area and affected area was collected from agriculture department of Jashpur district. This is followed by secondary injuries which are nothing but the manifestations of primary injuries like dieback or wilting of damaged plant parts, loss of plant height, staining, bruises, discoloration of damaged parts like leaves and fruits affecting their quality and rotting of damaged fruits and/or tender stems and branches due to fungal and bacterial infections [10].

Percentage sown area affected by hailstorm 1

Hailstorms were observed in many villages of Pathalgaon and Farsabhar block of Jashpur district. Weight of hails was found to be around 100 grams and its typical diameter was found near H0 to H3 categories [Fig-1], which severely damaged households, agricultural and horticultural crops. The affected area of summer paddy in affected villages of Pathalgaon block was 369.88 ha which was found 86% of net sown area of summer paddy as well as Wheat, Maize and Vegetable crops found affected by 18%, 7% and 29% area. On the other hand, 750.283 ha

area affected by hailstorm which was found 38% of net sown area based on information collected from the Agriculture Department furnished in [Table-2].

Similarly in affected villages of Farsabhar block, Summer Paddy, Maize, Wheat, Green Gram, Black Gram and Ground nut crops was found affected, in which the affected area of crops was 14.6 ha which was found 80% of net sown area of affected villages. On the other hand, area of pulse crop and maize were affected 100% and area of summer paddy, Wheat and Ground nut were affected by 80%, 86% and 46% respectively furnished in [Table-3]. During standard meteorological week no. 17th Hailstorm and moderate to heavy rainfall (RF) was observed at all the blocks of Jashpur district weekly rainfall and percentage deviation furnished in [Table-5].

Table-2 Crops affected by Hailstorm in Pathalgaon block

Crop	Net Area (ha) of affected villages	Affected Area (ha)	Affected Area (%)
Summer Paddy	428.68	369.88	86
Wheat	350.00	62.00	18
Maize	170.00	11.20	7
Vegetables	1041.50	307.20	29
Total	1990.183	750.283	38

Typical diameter was found near H0 to H3 category that differs from village to village and nature of damage also depends upon the size and intensity of hail and stages and nature of crops. here we have discussed the nature of damage of crops taken from selected formers from hail stone affected villages for different crops furnished in [Table-4]. Observations were recorded for the same crops in which onion at vegetative stage and remaining crops were at reproductive to harvesting stage during the incidence of hail stones [Fig-2]. In selected crops defoliation, tearing and shredding was observed in leaves, in addition, stem, vine and shoot breakage, stem bruising and dropping of flowers, fruit and leaves was observed described in [Table-4].

Table-4 Nature of damaging of various crops and plants affected by Hailstorm

Standing crops	Stage	Nature of damage
Summer Paddy	flowering & dough	Crop lodging, seed and grain quality deteriorated, Shattering of grains
Maize	Reproductive	Defoliation, stem bruises, tattered leaves, silk and tassels damage
Wheat	Harvesting	Lodging, disease/fungal development in spikes, fodder, seed and grain quality deteriorated, Shattering of spikes
Tomato	Fruiting/Flowering	Stem and shoot broken, Dropping of flowers and fruits, Disease and Pest infestation may increase, Lesions on fruits and stems
Brinjal	Fruiting/Flowering	Defoliation, Dropping of flowers, and fruits, Disease and pest infestation may increase, Lesions on fruits and stems, drying of leaves and broken shoots
Okra	Fruiting/Flowering	Dropping of flowers and leaves, stem broken, lodging, tattered leaves
Onion	Vegetative	Defoliation, broken leaves and stems, lodging
Bottle gourd	Flowering	Dropping of flowers and leaves, broken vine and bruises, tattered leaves and drying, Disease and pest infestation may increase,
Bitter gourd	Flowering	Dropping of flowers and leaves, broken vine and damage, Disease and pest infestation may increase
Banana	Fruiting/Flowering	Stem bruises, tattered leaves and drying

Table-5 Block wise normal RF and RF during SMW no 17th of 2020

Rain gauge stations	RF of Week no 17 th of 2020 (mm)	Normal weekly RF of Week no 17 th (mm)	Percentage Deviation (%)
Jashpur	17.8	4.7	279
Pathalgaon	42.0	3.9	977
Manora	20.0	0.1	19900
Bagicha	29.0	1.2	2317
Duldula	52.0	0.1	51900
Kunkuri	33.2	2.1	1481
Kansabel	36.0	0.3	11900
Farshabahr	57.2	1.6	3475
KVK Dumarbahar (Pathalgaon)	85.8	3.9	2100

Note: Weekly normal RF for KVK Dumarbahar taken from Pathalgaon block

Conclusion

Studies have concluded that most property damage begins when hailstone diameters are 20 mm or greater and vulnerability is more on rabi crops at harvesting stage, vegetables at fruiting/flowering stage and immature fruits of litchi and mango in the district during the study period. The larger the stones, typically the greater, the property damage [11]. In vegetables, defoliation, tearing and shredding was observed in leaves in addition, stem breakage, stem bruising and dropping of flowers and fruit was observed [12]. The impact caused by hail storm was experienced in all the crops however severity was found maximum at flowering, fruit setting stages of vegetables.

Application of research: The impact caused by hail storm was experienced in all the crops however severity was found maximum at flowering, fruit setting stages of vegetables.

Research Category: Disaster management

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